RUST GEOTECH INC.

Spectral Gamma-Ray Borehole
Log Data Report

Borehole 51-03-02

Log Event A

Borehole Information

Farm : TX	**Tank :** TX-103	**Site Number :** 299-W15-71
N-Coord : 41,690	**W-Coord :** 75,903	**TOC Elevation :** 671.44
Water Level, ft :	**Date Drilled :** 2/28/1949	

Casing Record

Type : Steel-welded	Thickness, in. : 0.313	ID, in. : 8
Top Depth, ft. : 0	Bottom Depth, ft. : 150	

Borehole Notes:

This borehole was drilled in mid-February 1949 to a depth of 150 ft. A starter casing was used for the first 20 ft, and the remainder of the borehole was drilled with a single casing diameter. The drill log does not indicate that the starter casing was withdrawn. Currently, only a single 8-in. casing is visible in the borehole. The drill logs do not mention grouting or cementing of the bottom of the borehole. The installed casing was perforated by cutting five holes per foot at staggered locations between depths of 60 and 100 ft.

The top of the casing is the starting depth for the logs. The casing lip is about 1 in. above the ground surface. The top of the casing is enclosed in a concrete collar that is cracked.

The casing thickness is presumed to be 0.322 in., on the basis of published thickness for schedule-40, 8-in. steel tubing.

Equipment Information

Logging System : 2	**Detector Type :** HPGe	**Detector Efficiency:** 35.0 %
Calibration Date : 10/1995	**Calibration Reference :** GJPO-HAN-3	**Logging Procedure :** P-GJPO-1783

Log Run Information

Log Run Number :	1	**Log Run Date :**	12/29/1995	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	0.0	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	20.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	2	**Log Run Date :**	1/2/1996	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	144.0	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	67.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

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Log Run Number :	3	**Log Run Date :**	1/3/1996	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	68.0	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	39.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	4	**Log Run Date :**	1/3/1996	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	40.0	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	19.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Analysis Information

Analyst : H.D. Mac Lean

Data Processing Reference : P-GJPO-1787 Analysis Date : 9/16/1996

Analysis Notes :

This borehole was logged with the SGLS in four logging runs. The third logging run was aborted due to high winds. The field verification spectra recorded immediately before and after the survey operation met the acceptance criteria established for the peak shape and system efficiency, confirming the SGLS system was operating within specifications. The energy calibration and peak-shape calibration from these verification spectra were used to establish the channel-to-energy parameters used in processing the spectra acquired during the logging operation.

The SGLS data were processed using a casing correction factor for 0.330-in.-thick steel casing.

Depth overlaps, where data were collected by separate logging runs in the same depth interval, occurred in this borehole between depths of 67 and 68 ft, between 39 and 40 ft, and between 19 and 20 ft. The concentrations of Cs-137 and the natural radionuclides were calculated using both the original and repeated log data sets at the overlapping points. The calculated concentrations of Cs-137, K-40, and Th-232 using the two separate data sets were within the statistical uncertainty of the measurements, indicating very good repeatability of the radionuclide concentration measurements. The calculated U-238 concentrations in the repeated depth intervals exceeded the experimental uncertainty. A hypothesis for the apparent discrepancies is included in Section 4.6 of the TSDR for tank TX-103.

Cs-137 was the only man-made radionuclide identified in this borehole. Noteworthy concentrations of Cs-137 occur from the surface to a depth of 6.5 ft and between depths of 36 and 41 ft. The measured peak Cs-137 concentration in the near-surface zone was about 15 pCi/g (at a depth of 1 ft) and about 6 pCi/g (at a depth of 40 ft) in the lower zone. Detectable amounts of Cs-137 also occur at depths of 11.5, 14.5, and 15.5 ft. Slightly contaminated zones occur between depths of 31.5 and 33 ft and between 34.5 and 35 ft. Except for the measurement at the 32-ft depth, most measured concentrations in these intervals were less than 1 pCi/g. The measured Cs-137 concentrations at the 32-ft depth were about 2 pCi/g. A slight increase in the SGLS total gamma count rate at the 40-ft depth is attributable to the Cs-137 contamination at this location.

Cs-137 concentrations slightly above the limit of detectability were also encountered intermittently in the depth interval between 42 and 130 ft. The perforations in the casing between depths of 60 and 100 ft are potential

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migration pathways and must be considered when interpreting sources of the contamination and possible migration routes.

Slightly elevated gamma-ray activity associated with the Cs-137 contamination in the near-surface zone (between the surface and 6.5 ft in depth) and within the zone at about the 40-ft depth is evident in the compilation of gross gamma-ray logs. Comparison of logs acquired during the past 15 years shows that the contaminants in the zones of elevated gamma-ray activity may have moved downward 2 to 3 ft.

Additional information and interpretations of log data are included in the main body of the TSDRs for tanks TX-102 and TX-103.

Log Plot Notes:

Separate log plots show the man-made radionuclides (Cs-137, Co-60, and Eu-154) and the naturally occurring radionuclides (KUT). The natural radionuclides can be used for lithology interpretations. The headings of the plots identify the specific gamma rays used to calculate the concentrations.

A combination plot includes both the man-made and natural radionuclides, in addition to the total gamma derived from the spectral data and the Tank Farm gross gamma log. The gross gamma plot displays the latest available digital data. No attempt has been made to adjust the depths of the gross gamma logs to coincide with the SGLS data.

Uncertainty bars on the plots show the statistical uncertainties for the measurements as 95-percent confidence intervals. Open circles on the plots give the MDL. The MDL of a radionuclide represents the lowest concentration at which positive identification of a gamma-ray peak is statistically defensible.

A compilation of representative gross count gamma-ray logs selected from available historical gross gamma logs recorded during the past 15 years is included. Logs have been selected to show relevant changes in gamma-ray activity over time.